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PROJECT :

Mastrad
BLE performance optimization

DOCUMENT :

Product BLE performance analysis SMART THERMOMETER BASE

REFERENCE : **AL/CH/2115/001**

DATE :	VERSION :	AUTHOR :
04/14/2021	**1A**	**C.Hamouda** **ALCIOM**

ABSTRACT :

This document presents the results of the performance analysis of the BLE PCB antenna of Mastrad's X2Prime product.

DOCUMENT HISTORY

DATE	AUTHOR VERSION 1A	COMMENT
04/14/2021	C.Hamouda	Study report

1 Introduction

The MASTRAD company develops and markets innovative and creative culinary accessories. MASTRAD markets in particular a MEAT°IT connected kitchen thermometer. This product includes a rechargeable temperature probe with a Bluetooth Low Energy (BLE) interface, and a charging base that also serves as a BLE relay to the user's smartphone.

MASTRAD is currently developing a new version of this product using PCB Antenna on the Repeater. In this context, MASTRAD asked ALCIOM for an expert report intended to BLE performance of the PCB Antenna.

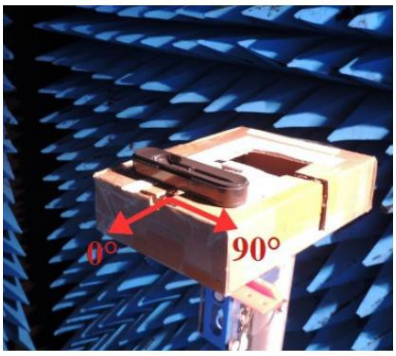
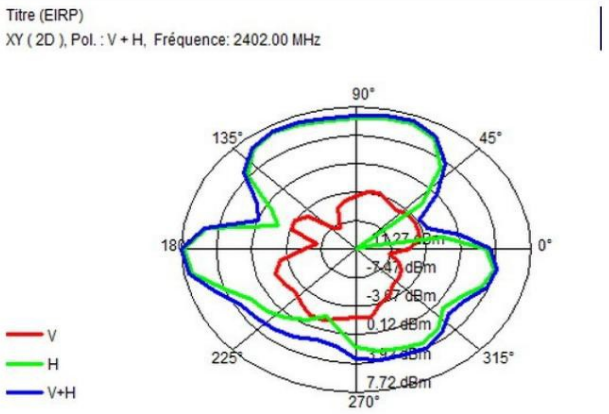
This document presents all the work carried out by ALCIOM in response to this request.

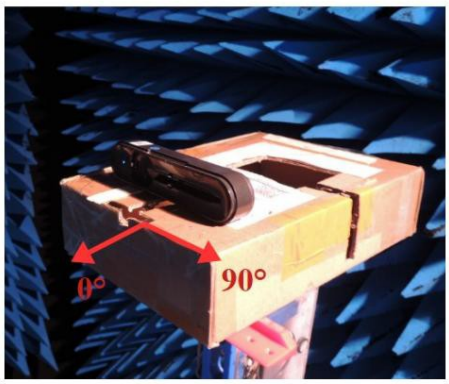
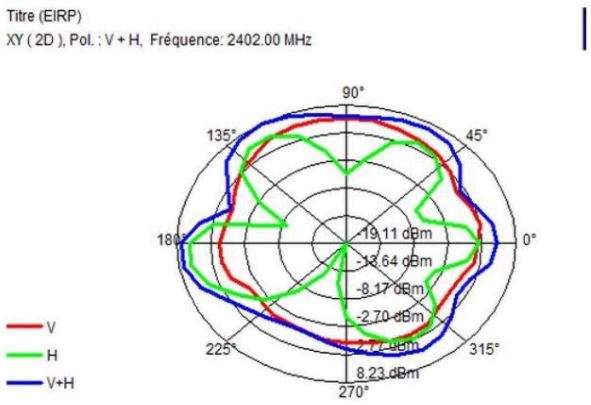
2.1 Measurement on the base

In radiated mode, and with default tuning network provided by the customer, initial measurement of the radiation pattern of the product. The measurement conditions will be as follows:

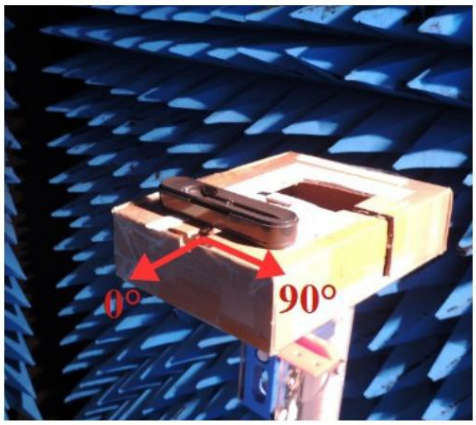
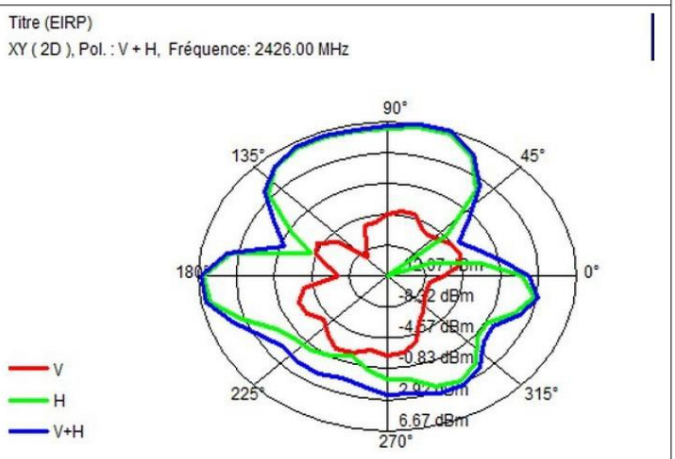
• Emission of advertising messages •
Measurement of the diagram on the 3 advertising channels: 2402 MHz, 2426 MHz, 2408 MHz • Measurement in vertical and horizontal polarizations • 2 measurement planes: xOy and xOz • Angular measurement step: 10 °

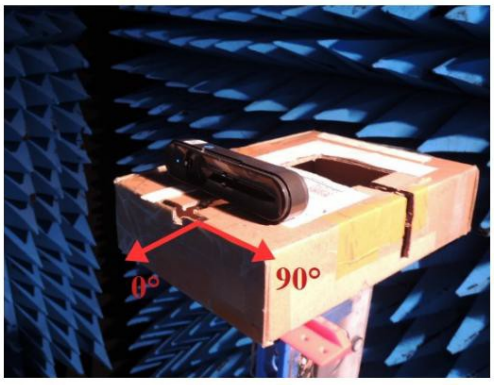
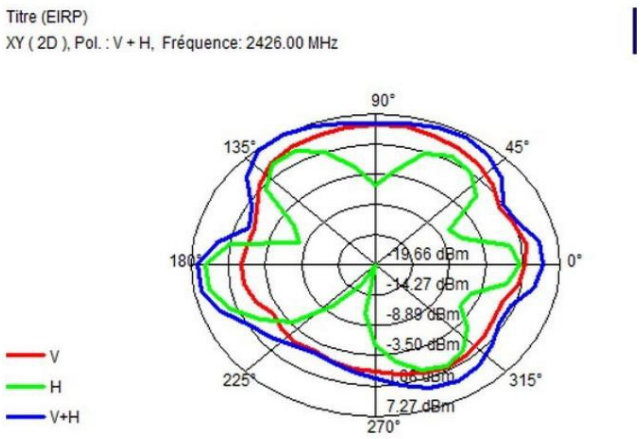
2.1.1 Measurement on the Low channel (Frequency = 2402 MHz)

Map xOy	
Measurement setup	EIRP [dBm]
	
Comments: - The radiation is maximum for angles around 90°, - The gain along the angles around 90° angles is greater than the gain around 270° angles by approximately 3 dB. - Two radiation peaks are observed around the 180 and 345° angles.	

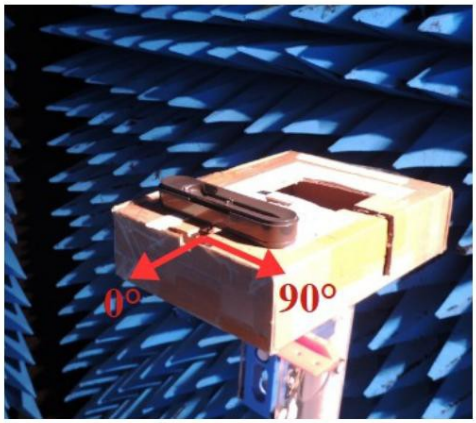
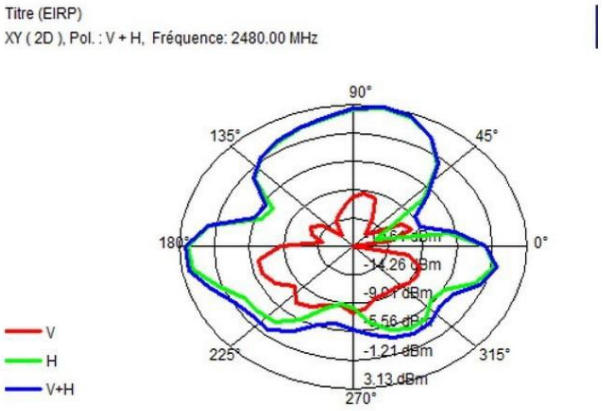
Map xOz	
Measurement setup	EIRP [dBm]
	
Comments: - The radiation is maximum for the angles 90°+/-45°, - The gain according to the angles around 90° is greater than the gain around the angles 270° by about 4 dB. - Two radiation peaks are observed around the 0° and 180° angles.	

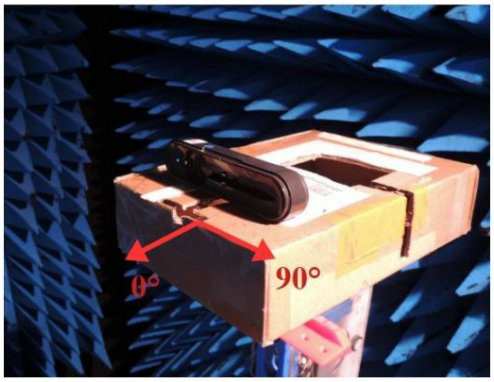
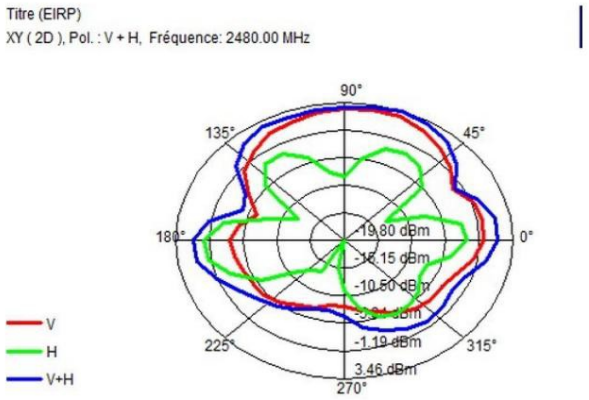
2.1.2 Measurement on the Med channel (Frequency = 2426 MHz)

Map xOy	
Measurement setup	Map xOy
	
Comments: - The radiation is maximum for angles around 90°, - The gain along the angles around 90° angles is greater than the gain around 270° angles by approximately 4 dB. - Two radiation peaks are observed around the 180 and 345° angles.	

Map xOz	
Measurement Setup	EIRP [dBm]
	
Comments: - The radiation is maximum for the angles 90°+/-45°, - The gain according to the angles around 90° is greater than the gain around the angles 270° by approximately 5 dB. - Two radiation peaks are observed around the 0° and 180° angles.	

2.1.3 Measurement on the High channel (Frequency = 2480 MHz)

Map xOy	
Measurement setup	EIRP [dBm]
	
Comments: - The radiation is maximum for angles around 90°, - The gain along the angles around 90° angles is greater than the gain around 270° angles by approximately 3 dB. - Two radiation peaks are observed around the 180 and 345° angles.	

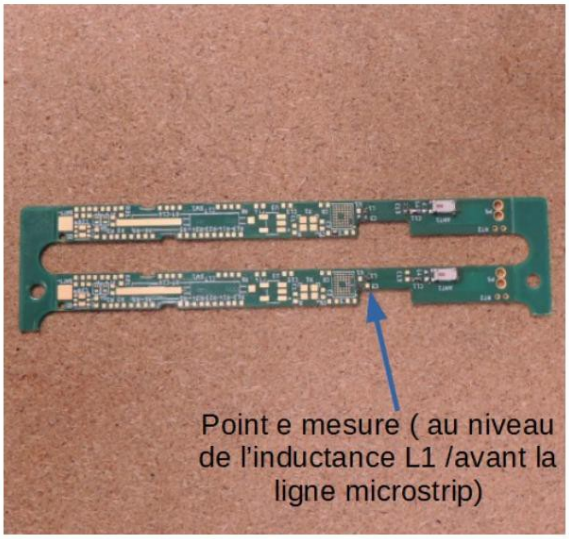
Map xOz	
Measurement setup	EIRP [dBm]
	
Comments: - The radiation is maximum for the angles 90°+/-45°, - The gain according to the angles around 90° is greater than the gain around the angles 270° by about 4 dB. - Two radiation peaks are observed around the 0° and 180° angles.	

2.2 Result and Comment

For the base, the radiation is maximum for angles around 90°, it is greater than the rear radiation by at least 3 dB. Two radiation peaks are observed around the 0° and 180° angles. **The power radiated by the base is around 8dBm.**

Communication is optimal if the probe is placed at a 90° angle from the base (this maximizes the direct path and the multi-paths that arrive at 90+/-45° angles from the base).

p to a distance of 2 mm)



3 Conclusions

The results obtained in this work can be summarized as follows:

For the base:

- Radiation is maximum for angles around 90°, it is greater than rear radiation (270°) by at least minus 3dB. Two radiation peaks are observed around the 0° and 180° angles. The maximum power radiated is of the order of 8dBm

- Communication is optimal if the probe is placed at a 90° angle from the base (this maximizes the direct path and the multi-paths which arrive at angles 90+/-45° from the base).

Drive power:

The driving powers of the two modules are almost the same (about 3.3 dBm). The difference in reach communication is therefore not linked to the electrical power supplied by the BLE chips.